

# StatE0

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## World Ecosystem Extent Dynamics

**A toolbox for countries to report on SEEA-EA accounts and GBF Headline indicator A.2**

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# World ecosystems under pressure

*“We lack information on the distribution of more than half of the world’s ecosystems - thus have little ability to track changes”*

*“Many countries simply don't have the necessary monitoring tools to manage their ecosystems sustainably”*

*“Many stakeholders, both nations and corporates need this information for their reporting (GBF, SEEA EA, TNFD, CSRD) and investments”*

# An ecosystem is not a land cover

## ***Land Cover (What is on top)***

Represents the physical and biological materials on the surface of the Earth, such as trees, grass, concrete, water, or bare soil. It describes the structural appearance of the landscape, typically in 10-15 classes.



## ***Ecosystems (How it functions)***

Defined by the IUCN as a dynamic complex of plant, animal, and micro-organism communities and their non-living environment, interacting as a functional unit, typically represented by 50-100+ classes.

# The solution

## World Ecosystem Extent Dynamics

A global applicable and scalable EO-integrated solution for mapping the **extent** and distribution of terrestrial, freshwater and coastal (up to the intertidal zones) ecosystems, monitoring their **changes in extent**, with country demonstrations

KO: 2 September 2024 | Duration: 24+6 months | World-series

# The solution delivers ....



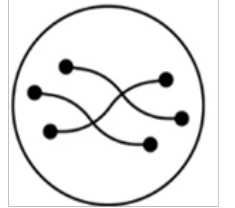
## Ecosystems characteristics open data-cube (200+ layers)

*Multi-modal EO, Context aware: global and national data; Semantic interoperable.*



## Ecosystem extent map

*Multi-typology (IUCN GET, EUNIS, EU-ETA), Multi-scale (10-30m), Multi-model*



## Ecosystem dynamics

*2018-2024, separate workflow*



## Indicators for policy support

*GBF A.2 (extent) indicator, SEEA EA accounting table*



## Documentation

*FAIR and automated (metadata)*

# Ecosystem Characteristics

- **EO Data + Data cube** covered by global geospatial data: 14 groups and 50+ unique datasets

Example characteristic

**Characteristic:** Hydroform

**Group:** surface water

**Variables(e.g.):**

- *Watercourse: A natural stream arising in a given drainage...*
- *Waterbody: Any mass of water having...*

HydroAtlas, GSW, GEODAR, CHELSA, HSWD, GAEZ, SoilGrids, OSM, Copernicus, MODIS, ESA CCI + other research data

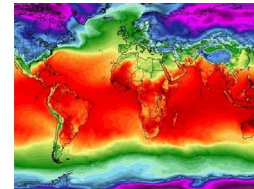
surface water



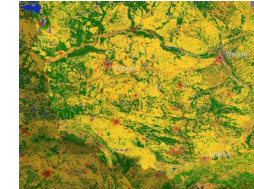
coastal



climate



land cover



soil



geomorphology



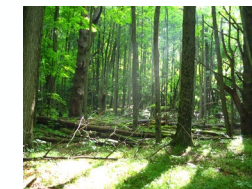
geothermal



anthropogenic



vegetation



ecosystem functioning



geological disturbances



biotic assemblages



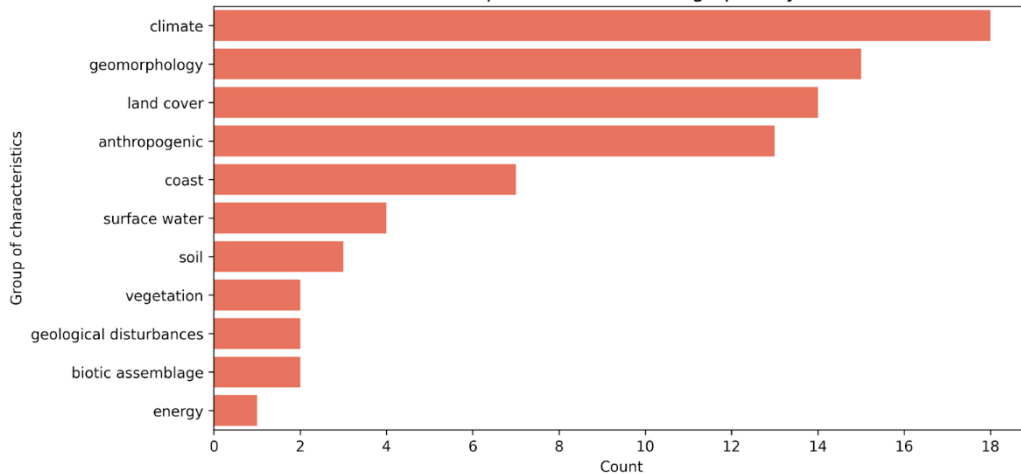
atmospheric disturbance



wildfires



Unique variables with high priority





# Ecosystem Map : Vietnam VN1 test-area

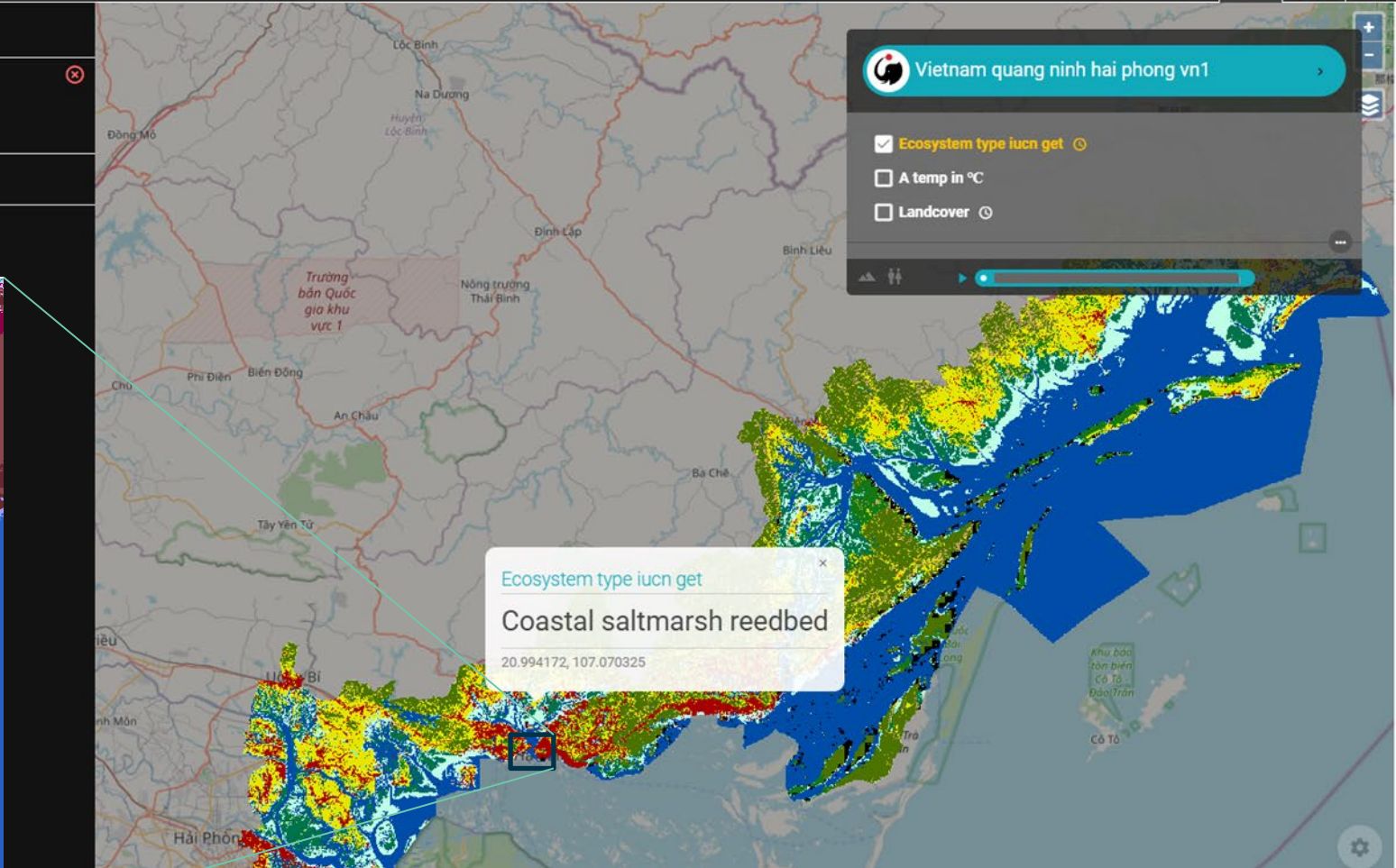
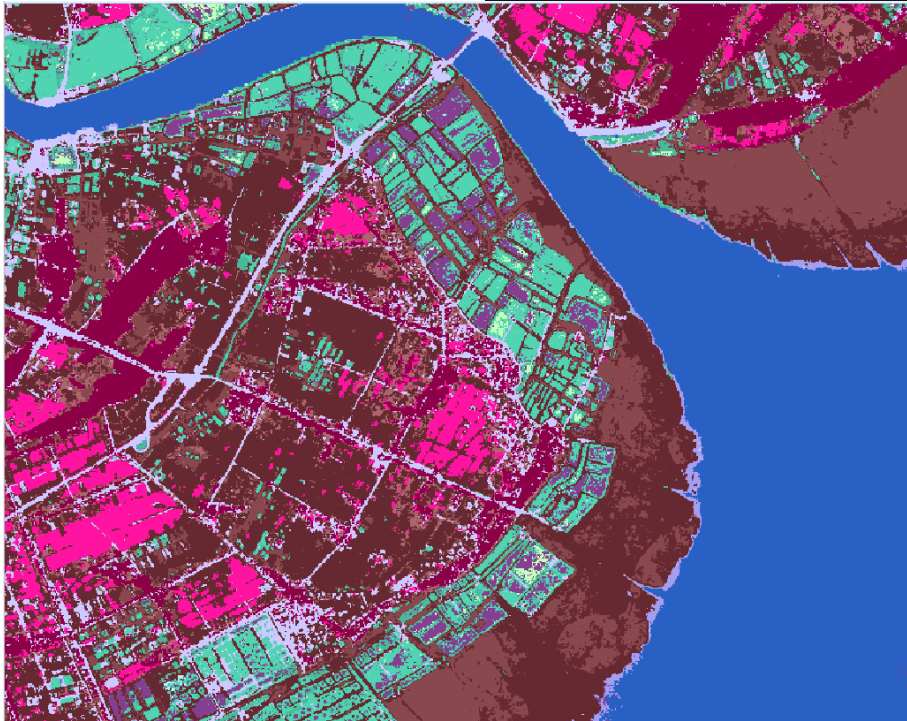
esa ARIES for ESA Demonstration version (Alpha 2/3)  
Ecosystem Types modeller powered by k.LAB semantic web technology and openEO

Context: where, when (2024)

Vietnam: Quang Ninh - Hai Phong VN1

Query Ecosystem Types according to:

IUCN GET (Rule-based global model - tier1)





# Interacting with WEED toolbox

WEED Toolbox User

Share data

Use tool frontend



Indicators

Extent map +  
Characteristics

WEED Toolbox User

10-30m L3 extent maps  
2018 – 2024 (annual maps)  
Characteristics

- **Global applicable**
  - Pre-trained models to enable first run in any place of world
  - Supports IUCN-GET & EU ecosystem typologies
- **Context aware**
  - Users can ingest own characteristics (e.g. soil map) and/or reference data (re-train models)
- **Integrated system**
  - A.2 GBF & SEEA EA accounts
  - Validation results (& uncertainties); in-situ protocol
  - Documentation
- **Build on State-of-art technologies**
  - Proven individually
  - Connected via Digital-twin concept



# Timing



## First Alpha version of toolbox



Proof-of-Concept

System generates ecosystem extent maps in zones from champion users (Colombia, Vietnam, South-Africa, Norway, CzechR, Greece)

June 2025

## Toolbox improvements, co-creation

Pilot maps

Sub-national maps from champion users  
Additional **test zones** optimized to cover all EFG (coastal, wetlands, ...), includes dynamics

3 cycles

## Toolbox ready for scale-up



Ready for validation

Able to generate ecosystem extent maps (EU, GET, Ramsar typologies) for 6 champion users + additional 5 (data poor) countries at **national scale**, incl. dynamics + indicators.

September 2026

## 1.0 version of toolbox ready for global deploy




Ready for public launch

**Validated** for 11 countries. EU continental available.

Able to generate ecosystem extent maps across any country at globe.

February 2027

## World Ecosystem Extent Dynamics Toolbox

- Measures extent of ecosystems, acc. standardized typologies, and their dynamics
- Global applicable, enabling the use of national data
- White-box approach (characteristics)
- Toolbox *for* countries → 
- Provides 'base' statistics for several high priority international policies

## Recommendations

1. More elaborate reference datasets (incl. change) : quantify - improve
2. Increase thematic detail (IUCN GET L4...) for use in national policies
3. Larger time-series to accommodate gradual changes (i.e. invasive species)

# Questions

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WORLD ECOSYSTEM EXTENT DYNAMICS (WEED)

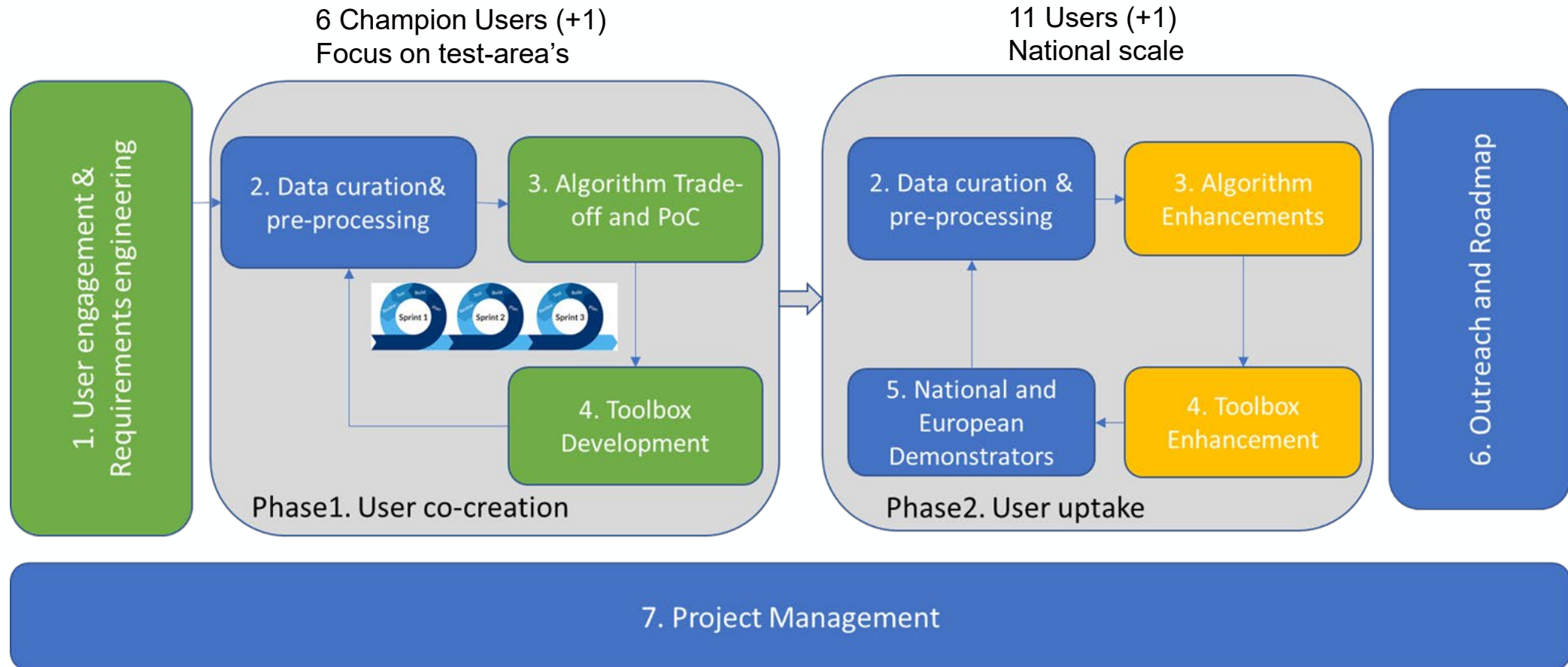
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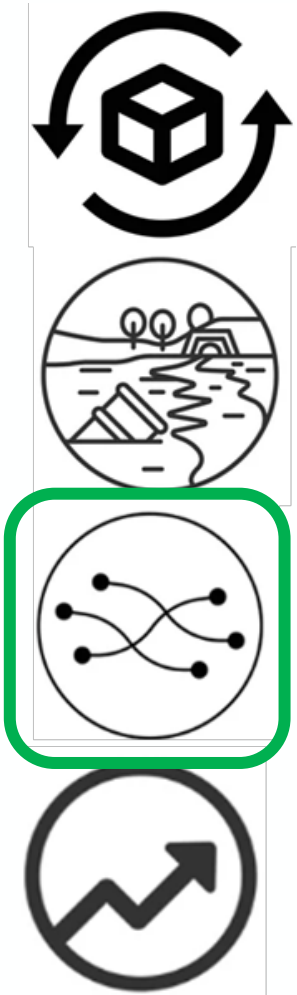
<https://esa-worldecosystems.org/en>



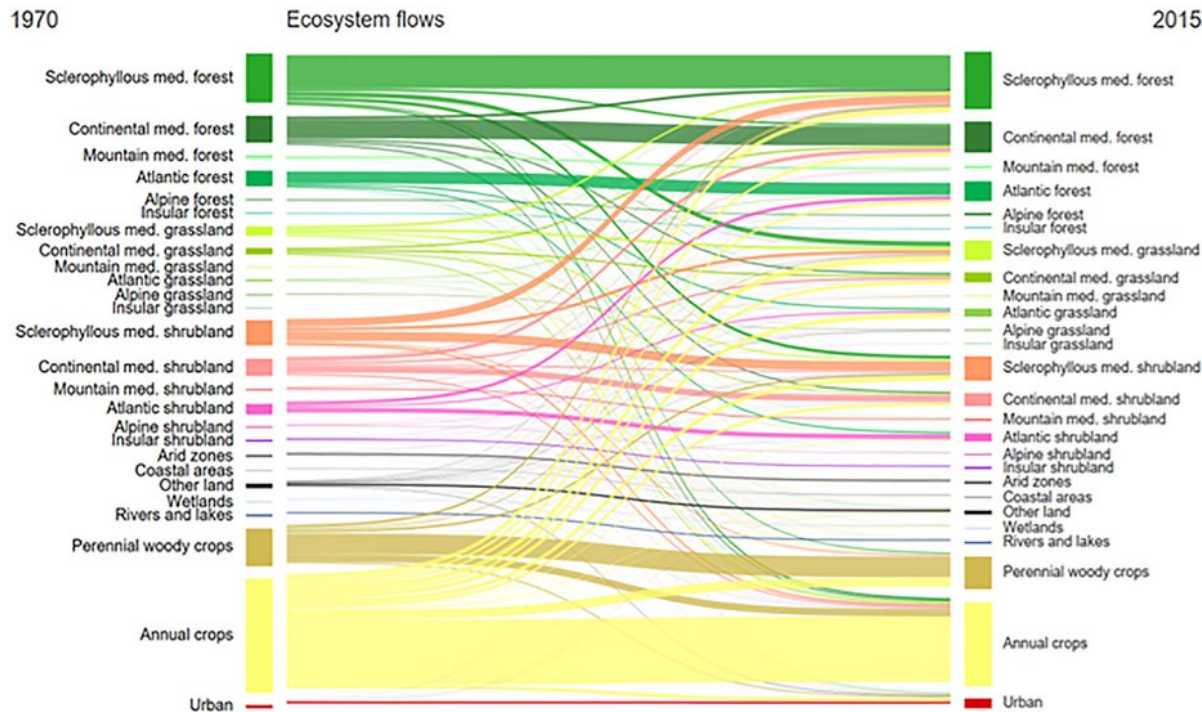
# 2 Phases



# The outputs of the toolbox/solution



## Ecosystem dynamics



[How the ecosystem extent is changing: A national-level accounting approach and application - ScienceDirect](#)

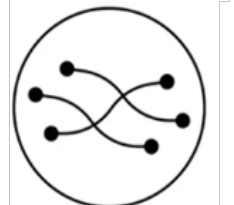
2018 – 2024 period

State-of-art (DL with domain knowledge / co-variances)

Abrupt changes  
Gradual changes

Seasonal variances as complementary information

# The outputs of the toolbox/solution



## Documentation : Transparency & automation

**ARIES for SEEA Explorer**  
The SEEA ecosystem accounting standard on the ARIES platform. A collaboration between UNSD, UNEP and BC3. Powered by k.LAB semantic web technology.

Context: where, when  
Euskadi  
Map boundaries: 305.0 m  
Years: 2010 To 2019

Study setup

Extent accounts

- Extent account: net balance
- Extent account: additions and reductions
- Ecosystem type: change matrix
- Land account: net balance
- Land account: additions and reductions
- Land cover type: change matrix

Condition accounts

Physical supply-use accounts

Monetary supply-use accounts

- Primary only (no subdivisions)
- Administrative subregions
- Protected areas

Key SEEA outputs

Ecosystem type

Reference atmospheric temperature  
WCS resource

Elevation  
WCS resource

Atmospheric temperature  
WCS resource

Presence of mountain  
WCS resource → NUMBER to BOOLEAN

Land cover type  
MERGED resource → Classify

Ratio of precipitation volume to potential evapotranspired water volume  
WCS resource → Evaluate

Lookup table

Region

klab.runtime.compileview

### im-data-global-climate.aridity\_index\_1970\_2000

This processing step retrieves the contents of a data or model resource from the semantic web. Resources can be data files, data services (using protocols such as OGC or OpenDAP), or may interface to more complex computations or running simulations.

Resources are identified by a unique Uniform Resource Name (URN) used together with the scale of observation to retrieve data or trigger computation. Metadata and provenance records associated with this resource are shown below.

#### Title

The Global Aridity Index

#### Originator

CGIAR-CSI

#### Description

Aridity Index represents the ratio between precipitation and ET<sub>0</sub>, thus rainfall over vegetation water demand (aggregated on annual basis). Under this formulation, Aridity Index values increase for more humid conditions, and decrease with more arid conditions. Data resolution is 30 arc seconds or ~ 1 km at the equator.

#### URL

<https://cgiarcsi.community/data/global-aridity-and-pet-database/>, [https://figshare.com/articles/Global\\_Aridity\\_Index\\_and\\_Potential\\_Evapotranspiration\\_ET0\\_Climate\\_Database\\_v2/7504448/3](https://figshare.com/articles/Global_Aridity_Index_and_Potential_Evapotranspiration_ET0_Climate_Database_v2/7504448/3)

#### Keywords

Aridity

# Link with GEO-Atlas

## Our solution

Official technology provider to the synthesis map of GEO-Atlas, through the countries.

Going beyond offering a one-stop solution:

- Scalable
  - Applicable to any country in globe
  - Limited (no programming skills) to advanced technical capabilities
- Flexible
  - Supports multiple typologies (IUCN GET, EU/EUNIS typology, Ramsar)
  - Context-aware
- Monitoring change
  - from 2018 onwards

